HENNEPIN COUNTY
EMERGENCY MEDICAL SERVICES

I-35W BRIDGE COLLAPSE

AUGUST 1, 2007

Thomas Ward B.A. EMT-P

toward2211@msn.com

Overview

- Collapse
- Response
- Communications
- Command
- Lessons learned
- Triage /Injury Dynamics/Transport
- Hospital Response
- Additional Considerations: Large MCI
- Reflections

Population Statistics

- 2.8 million — 7 County Metro Area
- 1,152,500 — Hennepin County
- 387,970 — Minneapolis
- 286,620 — St Paul

EMS Statistics

- 277,000 runs — EMS 7 County Region
- 57,000 runs — Hennepin County EMS
  - 19 ambulances in fleet *
  - 13 crews on duty 6 PM Aug 1, 2007 *
  - 107 * Paramedics, 15 EMDs, 10 Mgt

* August 2007 information

I-35W Bridge

- **Built 1967**
- **Rated as: 'structurally deficient, but not in immediate need of replacement'**
- **1900 ft length / 450 ft span**
- **Deck 116 ft above water**
- **141,000 cars / day**
- **Mississippi 390 ft wide**
- **Water depth: 9-15 ft**
- **Steel truss arch bridge**

Initial EMS Response

From receipt of first 911 call:

- **20 minutes : EMS positioned in all critical areas of collapse zone (8 crews, 2 command staff)**
- **30 minutes: patient transport had begun from each end of bridge**
- **40 minutes: 20 + crews, 4 command staff**
  - Includes mutual aid from North, Allina, Lakes Region, Kanabec County with Edina and Ridgeview covering our west service area.

Hennepin County
Medical Center

Public Safety Response

Minneapolis Fire

- 19 engines, 6 ladders, 2 heavy rescue
- 4 Battalion Chiefs and Deputy
- 3 boat companies
- Mutual aid command staff
- ~ 100 MFD firefighters (~300 on call back)
- ~ 30 mutual aid companies

Minneapolis Police

- ~ 700 city and mutual aid officers in first 2 hours
- Park Police, U of M, mutual aid

Hennepin County Sheriff

- 150 responded in first 30 mins
- ~ 400 within first 24 hours

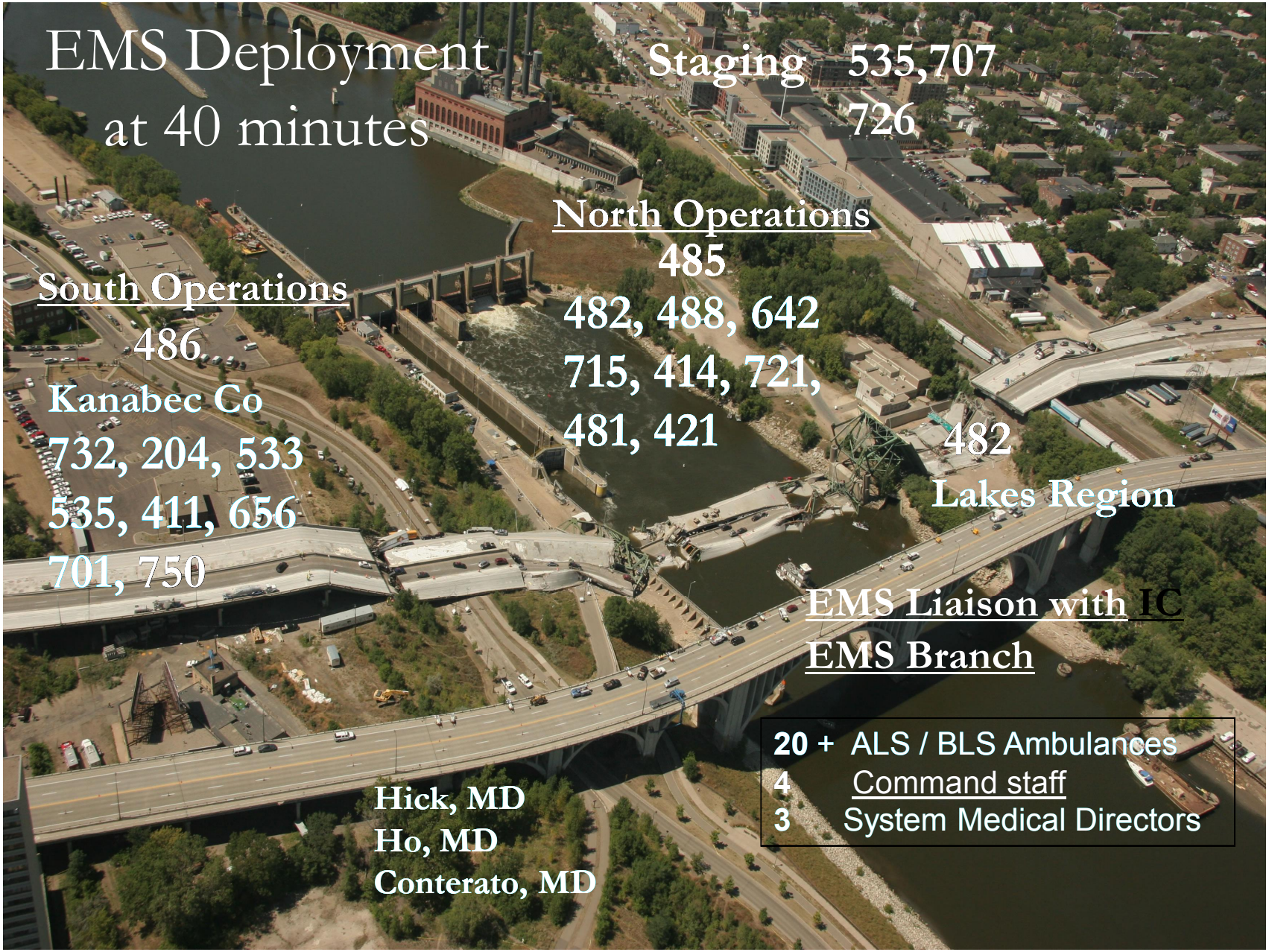
Water Patrol

- 12 mutual aid agencies (28 boats) in first hour
- DNR: 12 additional boats
- USCG boats from St Paul and (2) 25' boats from Omaha (in 5 hrs)
- 20 divers from Hennepin Co, Dakota Co and Hudson Wisc

Minnesota Highway Patrol

- ~ 100 officers in initial response

Hennepin County
Medical Center


EMS Deployment
at 40 minutes
Staging 535,707
726
North Operations
485
482, 488, 642
715, 414, 721,
481, 421
South Operations
486
Kanabec Co
732, 204, 533
535, 411, 656
701, 750
482
Lakes Region
EMS Liaison with IC
EMS Branch
20 + ALS / BLS Ambulances
4 Command staff
3 System Medical Directors
Hick, MD
Ho, MD
Conterato, MD

EMS Response Summary

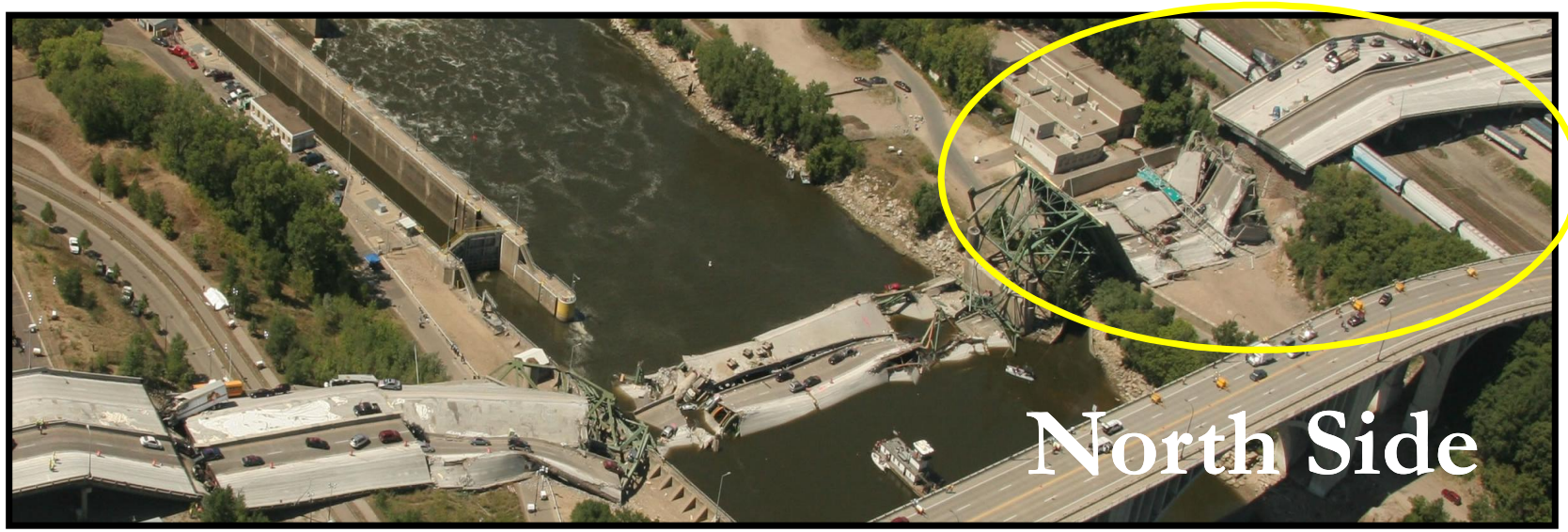
- **Collapse to last patient transported:**
  - **Initial clearing of all sectors: 1 hr 35 mins**
  - **Last EMS transport: 2 hrs 6 mins**

- **50 patients transported by EMS**
- **8-13 casualties via other vehicle**
- **Over 100 patients treated in 24 hours**
- **13 deaths**
- **29 ambulances used in first 4 hours**
- **No serious injuries to first responders**

Early Challenges

- Disbelief
- Disconnect: destruction vs casualties
- Simultaneous rescues and extrications
- Multiple hazards: moving water, submerged vehicles, confined space, stacked vehicles, shifting unstable surfaces, falling debris, overhanging structures, fires, hazardous materials and energized power lines
- Coordinating both sides of the river
- Defining operational areas
- Confusing geography / streets

Hennepin County
Medical Center

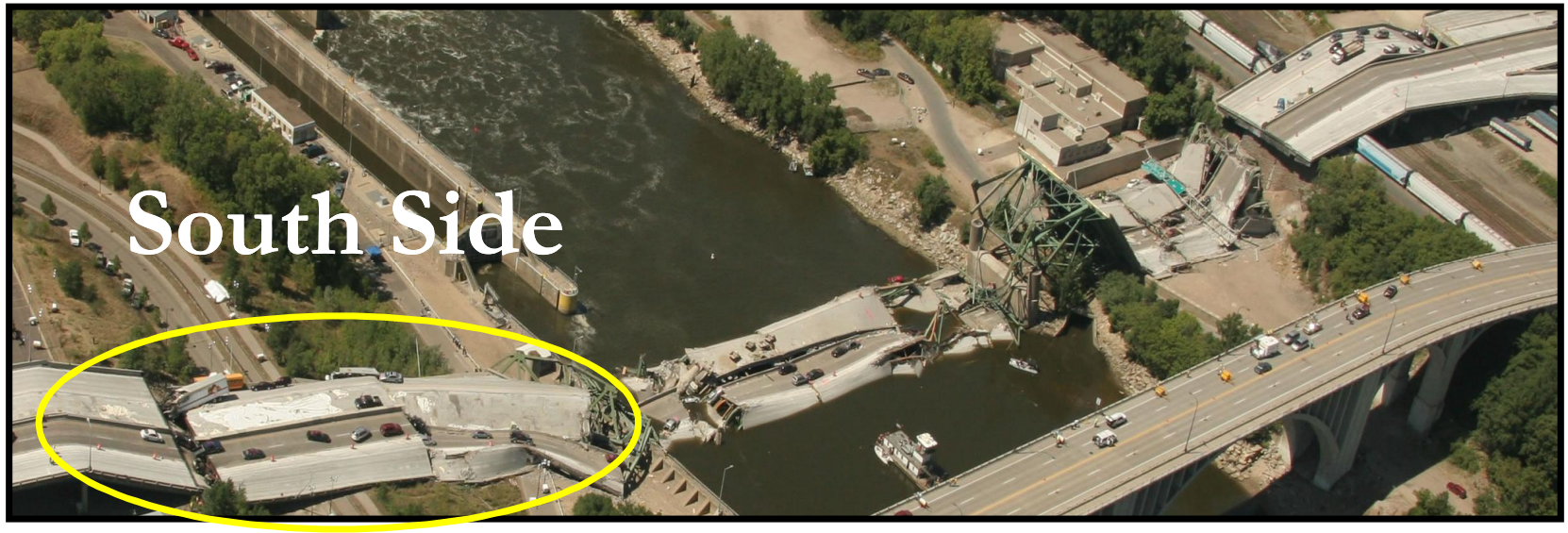


Challenges

- 8 foot wall - patients passed down ladder on backboards
- Many bystanders and civilian medical assistance
- No perimeter control for first hour
- Delays getting ambulances to downstream side -pickups used to transport
- Hazards – threatening collapse, falling debris, hazmat(s), downed power lines

Challenges

- Poor access from shore
- Initial water rescues by police and civilians
- Most evacuations by MFD boats to shore
- 1 CPR on span – efforts terminated on scene
- River currents, rebar, debris
- Threat from towering collapsed roadway



Challenges

- Fires and smoke
- School bus – corralling injured students
- Precariously positioned vehicles
- Fire hoses blocking EMS access
- Falling vehicles and shifting debris
- Significant elevation changes


Staging
Power Plant
X
X
"Power Plant"
Coal Shack

Communications

- Staffing and division of labor
- Notifications
- Mutual Aid
- 800 MHz system / ETAC 1
- MNTrac
- Issues:
  - –Channel overload
  - –Phone traffic
  - –Lack of information from scene

Hennepin County
Medical Center

Analysis of EMS Communications

ETAC 1 (Primary Talk Group) 800 MHz

- Never failed, but too many users and frequent busy signals
- Initial call for 2nd channel over-ruled by EMSBr – insufficient staff to monitor multiple channels
- Requests to limit radio traffic to essential command traffic, but no alternative given for general information
- Freelancing on other channels

Identification of Resources

- Unable to determine resource by call number. Need a consistent protocol:

  Service / resource type / number

  " Hennepin / Ambulance / 414 "

Medical Resource Control Center (MRCC) Not Fully Utilized

- Crews often failed to notify MRCC
- Regional Incident Response Plan assigns all patient tracking and coordination to MRCC
- MRCC controlled only 20% of patients
- Dispatch gave frequent reminders
- Records updated after the event

Hennepin County
Medical Center


MNTrac
Logged in as West MRCC
Hospital Surge Capacity Alert - hospital
Updated: Tuesday 11/28/2006 at 16:33:06 by Imagetrend Admin
View Report
View Map
Regional Status
Alert Manager
Command Center
Reports
Logout
Save Filter Settings
Regional Status
Reset MCI Counters
15:23:15
Loaded Tuesday, 21 August, 2007 at 3:23:21
Info
Facility
Region
Diversion Status
Diversion Updated
Beds Available
Abbott Northwestern Hospital - Minneapolis West Metro Closed to ED & Trauma for 0:04 of 4:00 08/21/2007 03:18 PM 15 25 50
Fairview Ridges Hospital - Burnsville East Metro Closed to OB Only for 0:00 08/21/2007 03:22 PM 5 10 25
Hennepin County Medical Center West Metro Closed to ED Only for 0:00 of 4:00 08/21/2007 03:23 PM 15 25 50
Bethesda Rehab Hospital - St.paul East Metro Open 08/21/2007 03:21 PM 0 0 0
Children's Hospital - Minneapolis West Metro Open 12/03/2006 11:22 PM 5 10 25
Children's Hospital - St. Paul East Metro Open 09/28/2006 05:54 PM 5 10 25
Fairview Riverside Hospital - Minneapolis West Metro Open 09/28/2006 06:14 PM 7 15 25
Fairview Southdale Hospital - Edina West Metro Open 09/27/2006 01:07 PM 2 5 15
Fairview University Medical Center - Minneapolis West Metro Open 09/28/2006 05:20 PM 5 10 25
Gillette Children's - St. Paul East Metro Open 04/21/2006 03:45 PM 0 0 0
Lakeview Hospital - Stillwater East Metro Open 05/24/2006 11:15 AM 5 10 25
Mercy Hospital - Coon Rapids West Metro Open 05/03/2007 03:06 PM 5 10 25
Methodist Hospital - St. Louis Park West Metro Open 09/27/2006 01:37 PM 5 15 25
North Memorial Medical Center West Metro Open 09/27/2006 01:02 PM 15 25 50
Northfield Hospital East Metro Open 09/23/2005 12:00 AM 2 5 15
Queen Of Peace Hospital - New Prague West Metro Open 01/18/2006 04:29 PM 2 5 15
Regina Hospital - Hastings East Metro Open 05/24/2006 11:15 AM 5 10 25
Regions Hospital - St. Paul East Metro Open 01/02/2007 10:03 AM 15 25 50
Ridgeview Medical Center West Metro Open 02/09/2006 02:33 PM 5 10 25
St. Francis Regional Medical Center - Shakopee West Metro Open 07/25/2006 10:49 AM 5 10 25
St. John's Hospital - Maplewood East Metro Open 02/09/2006 02:32 PM 5 15 25
St. Joseph's Hospital - St. Paul East Metro Open 02/09/2006 02:32 PM 5 15 25
St. Joseph's Hospital - St. Paul East Metro Open 02/09/2006 02:32 PM 5 15 25
United Hospital - St. Paul East Metro Open 05/02/2006 09:51 AM 5 15 25
Unity Hospital - Fridley West Metro Open 09/27/2005 10:57 PM 5 10 25
Va Medical Center - Minneapolis West Metro Open 09/27/2005 11:03 PM 0 0 0
Valley Hospital At Hidden Lakes - Golden Valley West Metro Open 09/27/2005 10:49 PM 0 0 0
Woodwinds Hospital - Woodbury East Metro Open 04/24/2006 10:16 AM 5 10 25
Open
Closed to ED Only
Closed to OB Only
Closed to Trauma Only
Closed to ED & OB
Closed to ED & Trauma

Family Assistance Center

Holiday Inn 8/1 - 8/3 Augsburg College 8/3 – 8/11

Mission: Provide psychological first aid, gather and disseminate information to families of missing persons and victims

- Privacy / media free zone
- Honesty / support / rumor control MDH
- Formal briefings by MPD, Sheriff Dept, M.E. , FBI, NTSB
- Anticipate needs / cultural sensitivity
- Death notifications
- 70-100 individuals served daily (first 4 days)
- 185 staff involved / 3,465 staff hours

Lead Agencies: MPD, Minneapolis Dept of Health and Family Support, American Red Cross MDH
Assisting: Hennepin County Human Services, Salvation Army, Medical Reserve Corps, PD Chaplain Corps, U of M, multiple law enforcement agencies, Hennepin County Medical Examiner

PROGRESSION OF THE EMS COMMAND STRUCTURE

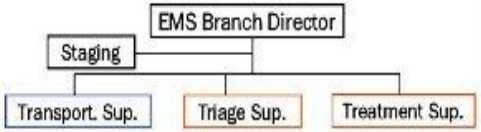
Single Ambulance Response

EMS Branch Director/Transportation Supervisor

Triage Supervisor

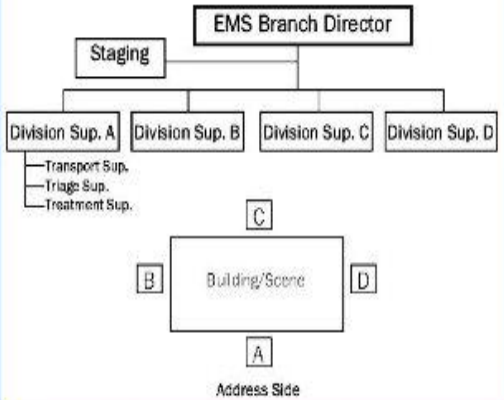
Multi-Unit Response

- Fill only those positions that are necessary to manage the incident.



Multi-Division Organization

- In large or widely scattered scenes, Divisions may be established to provide better control of the incident.
- A Division represents a geographic location. Division Supervisors may be identified by their geographic location.
- Divisions operate independently, Division Supervisors report to the EMS Branch Director.
- Requests for resources (vehicles, talkgroups, personnel, etc.) must be made through the EMS Branch Director.



ADDITIONAL GUIDELINES

COMMUNICATIONS:

- On scene, most communication should be done face to face. Only those in ICS Supervisor positions should be using radios and keep traffic short.
- Use Plain English, NO 10-codes.
- All responders will identify themselves using the following format: Dept Name, Type of Resource, and Radio #. This format will be known as Radio ID.
- Cell phone use is strongly discouraged.
- Resources assigned to an incident can only be reassigned or cancelled under the authority of the EMS Branch Director.
- EMS, hospitals and other agencies seeking scene updates should log-on to MNTrac, and not call MRCC or Communication Centers.
- Requests for additional talkgroups must be made to, and approved by, the EMS Branch Director who will coordinate with the controlling Communication Center.

OPERATIONAL CONSIDERATIONS:

- Ensure crews are wearing proper protective equipment.
- Ensure crews are wearing identification vests.
- Off-site Staging.
- MCI Trailer/additional supplies.
- Use of mutual-aid management staff.
- Buses for transport or shelter.
- Long term operations including relief/rehab for EMS staff.
- Need for volunteer agencies (Red Cross, Salvation Army, etc.).
- Demobilization.
- Psychological after-care.

Metro Region EMS

EMERGENCY MEDICAL SERVICES INCIDENT RESPONSE PLAN

GUIDELINES:

This plan is based on the principles and guidelines of the National Incident Management System (NIMS) and assumes responders have a working knowledge of the Incident Command System (ICS) and the positions it utilizes.

- The command structure presented in this plan may require expansion to meet the needs of larger or more complex incidents.
- Refer to agency specific guidelines for special incidents: HazMat, Police Tactical Operation, Fire Standby, Water Rescue, etc.

- The agency communication center will notify MRCC every time they use an ETAC talkgroup.
- **FIRST ARRIVING CREW:** *Refer to Panels A & B .*
- **2nd IN or LATE ARRIVING AMBULANCES:** Refer to Panel C.
- **Do NOT respond unless requested!**

HAZMAT RESPONSE

- Check temp., humidity, wind speed & direction.
- Identify safe access routes and staging areas.
- Ensure proper use of protective equipment.
- Consult with Incident Command to establish cold zones and decontamination process.
- Collection of patients in Cold Zone is preferred.
- Decontaminate patients prior to triage and transport.
- Contact MRCC/Medical Control of the potential for contaminated patients to self transport.

Revised: January 2008

A — EMS BRANCH DIRECTOR/TRANSPORTATION

(Report to Incident Command/form Unified Command)

- Upon arrival at the scene, the role of EMS Branch Director will be assumed by an individual and announced on the radio. (Example: "[name] will be EMS Branch Director.") Any change in the person filling the role must also be announced.
- The EMS Branch Director is responsible for all positions within the Incident Response Plan (IRP) until delegated.
- Radio discipline on scene is maintained by allowing only the EMS Branch Director to communicate with the Communication Center.
- To manage complex incidents, the EMS Branch Director may appoint staff to serve as Assistants.
- The EMS Branch Director must provide regular Situation Reports (Sitreps).

SCENE SIZE-UP

It is vital to communicate an accurate scene size-up so the appropriate resources can be started. It is better to start more resources and cancel them, than to have a delayed response.

The information should include:

- Type of Incident.
- Potential number of patients.
- Types of injuries.
- Severity of injuries.
- Give staging location.
- Best route in/out.
- Is on-call Medical Director needed?
- Do hospitals need to be alerted to the incident?

The communication center or MRCC may prompt the EMS Branch Director for information not given during the scene size-up.

TRANSPORTATION SUPERVISOR

(Report to EMS Branch Director or Division Supervisor)

- Requests for resources must be made to the EMS Branch Director.
- Coordinate the rapid loading of transporting vehicles.
- Track the number of patients transported by each vehicle.
- Keep entry/exit routes open.

B — TRIAGE SUPERVISOR

(Report to Transportation Supervisor)

- Triage supervisor maintains role of Treatment Supervisor unless it is delegated.
- Coordinate with Transportation Supervisor to expedite patient movement.

1. Provide EMS Branch Director with approximate number of patients
2. Identify, corral, and monitor "walking wounded".
3. Complete triage process, identifying critical patients.
4. Update EMS Branch Director with number of patients and acuity.

TRIAGE

GREEN

- **"Walking Wounded" or injuries treated by first-aid alone.**

YELLOW

- **Follows simple commands.**
- **Minor injuries but unable to ambulate.**

RED

- **Unable to follow simple commands.**
- **Respiratory Distress**
- **Signs of Shock**

TREATMENT SUPERVISOR

(Report to EMS Branch Director or Division Supervisor)

- Organize medical care in treatment area.
- Determine need for supplies and staff in treatment area.
- Provide for medical need of all "walking wounded."
- Direct First Responders when caring for multiple patients.

C — 2nd IN or LATE ARRIVING AMBULANCES

(Report to EMS Branch Director or designee)

Notification

1. Go to assigned radio tactical talkgroup.
2. Contact the Communication Center of the agency controlling the incident for instructions.
3. Approach scene using designated route to avoid hazards.
4. Upon arrival at assigned area, contact the EMS Branch Director, or Staging Supervisor if established.
5. All responders will identify themselves using the following format: Dept Name, Type of Resource, and Radio #.

At Staging

- Leave keys in ignition.
- Stay inside the vehicle until assigned a duty.
- Remember other vehicles, do not block entry/exit routes.

Loading Patients and Leaving the Scene

1. **Quickly load patients and provide treatment enroute!**
2. Notify EMS Branch Director, or Transportation Supervisor if established, of the number of patients being transported.
3. Immediately contact MRCC/Medical Control by radio on the MRCC talkgroup. Give radio ID, destination, age, gender, patient name, triage color, and chief complaint.
4. Contact your Communication Center and advise them of your status.
5. Before clearing hospital, crews must contact MRCC/Medical Control and give patient names and/or identification if not given previously.

STAGING SUPERVISOR

(Report to EMS Branch Director or designee)

- Establish staging area and keep entry/exit routes open.
- Respond to requests for resources from the EMS Branch Director or designee.
- Assign the appropriate resource to meet request.
- Provide requested resources with location of assignment, talkgroup, and any special instructions.
- Keep EMS Branch Director updated on resources in staging.

What Worked - EMS

- Crews knew and followed Incident Response Plan
- First-in crews took command of their divisions
- Orderly transfer / expansion / contraction of command
- Excellent interaction between EMS and all responders
- Rapid patient assessment and transport
  - No delays moving patients when rigs on scene
  - Good critical thinking and problem solving
- Timely / coordinated mutual aid response
- Directing activities of civilian rescuers
- Radio System:
  - Communication Center well staffed
  - Radio channels congested – but did not fail
- MNTrac
- No serious responder injuries – safety equipment

Hennepin County
Medical Center

What Could Have Gone Better - EMS

- Control of initial response:
  - Crews acted on their own
  - Dispatch / EMS Branch struggled on radio
- Needed plan to use EMS Command Staff
- Incomplete situation updates from scene
- Procedures not followed:
  - No MCI vests / triage tags not used
  - Poor patient tracking/coordination/documentation
- Radio discipline / tactical channel congestion
- Poor accountability of resources
- Volunteers: very helpful - then major distraction
- Navigation: wrong information / confusion
- Multiple staging sites: locations / leadership

Hennepin County
Medical Center

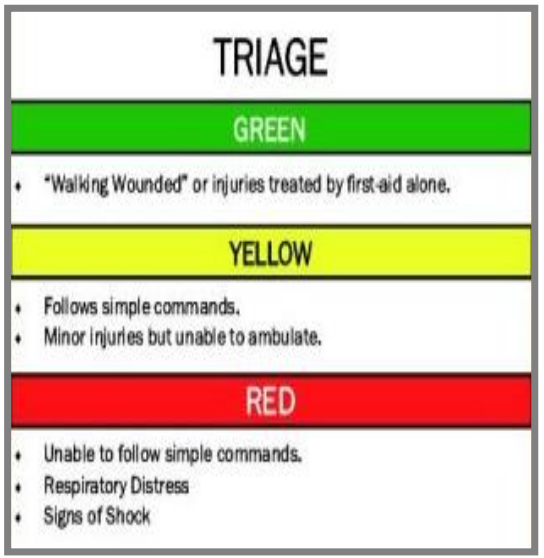
Corrective Actions - EMS

- Modify Response Plan
  - More EMS Command support positions
  - Response Plan should mirror daily operations
  - Protocols to limit radio congestion
  - Improve compliance with MRCC procedures
- Ensure EMS representation in EOC's
- Use lessons from bridge response for future event planning - RNC
- Promote greater use of Incident Response Plan
- Continue strengthening ties among EMS providers and with first responders

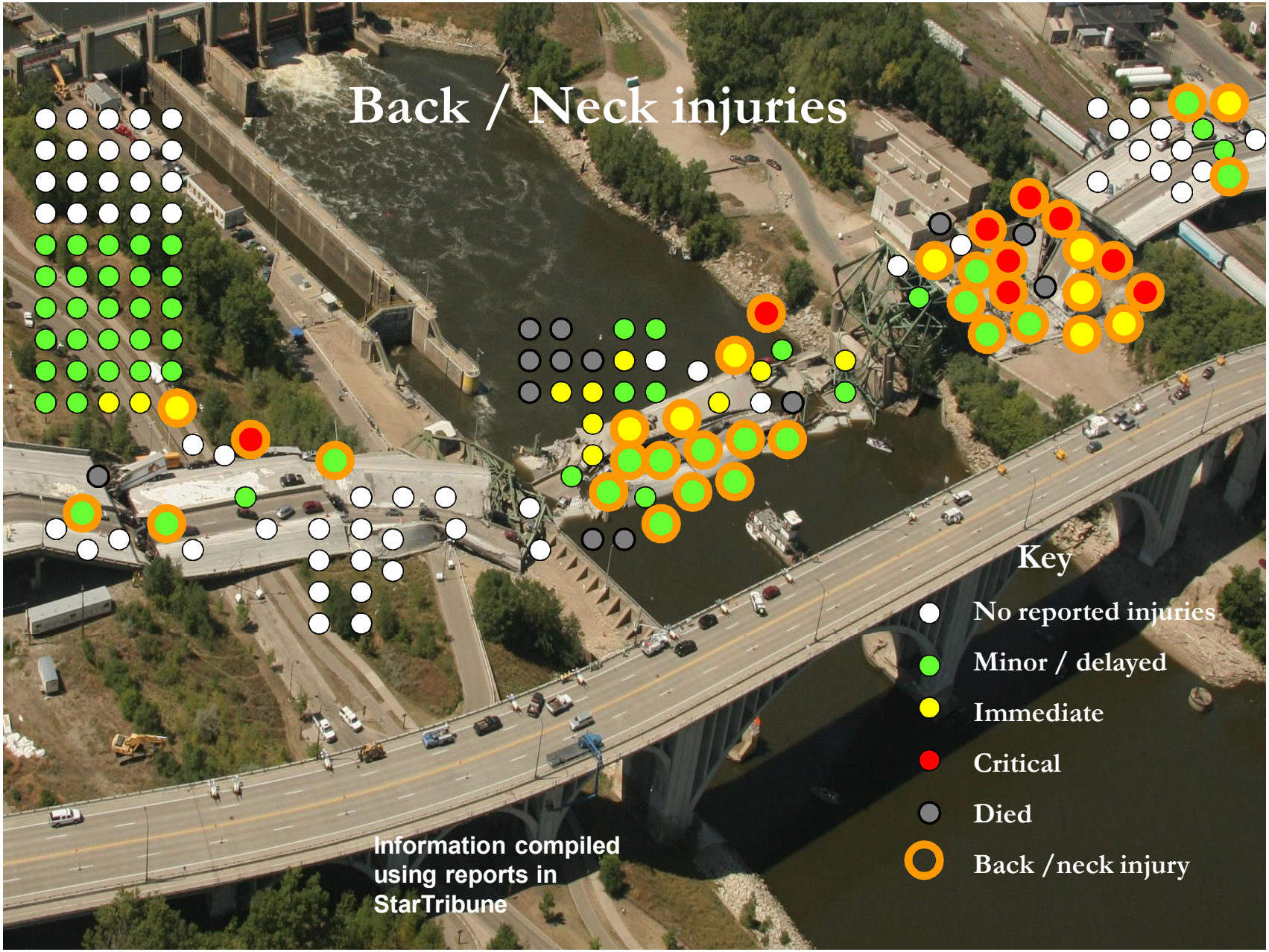
Hennepin County
Medical Center

Triage

- **Most patients triaged without tags**
  - **MCI Bags left in ambulances**
  - **Not normal practice**
- **Response Plan: triage categories**
- **Identical bags on all ambulances**
- **Medics assessed pts rapidly following standard procedures**
  - **Intuitive process worked**
  - **Rigid abdomen, pallor (RED)**
  - **Thoracic or abdominal injuries may be under-triaged using START**



Hennepin County
Medical Center

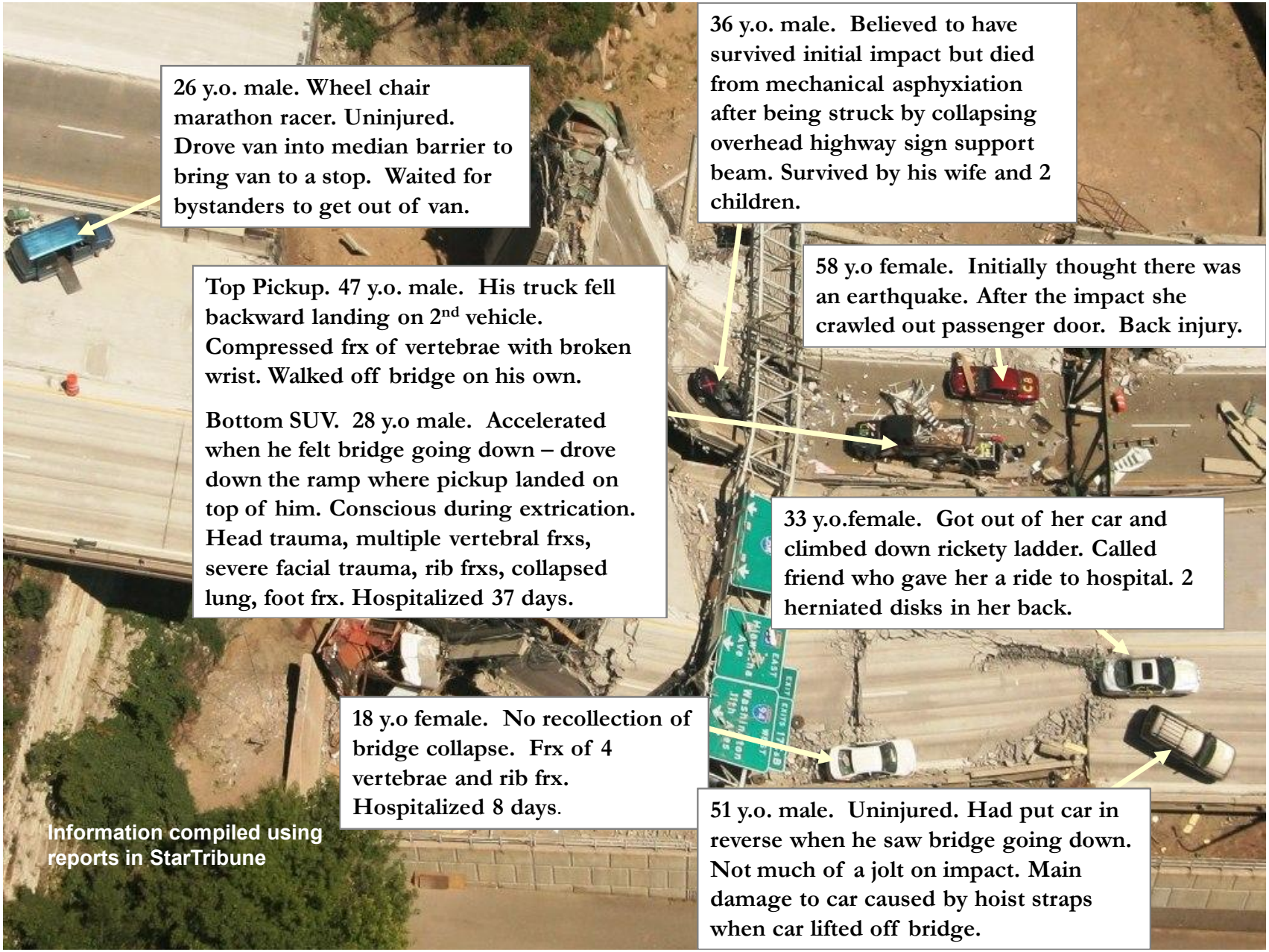

Back / Neck injuries
Key
No reported injuries
Minor / delayed
Immediate
Critical
Died
Back /neck injury
Information compiled using reports in StarTribune

Factors that Influenced Casualty Rate

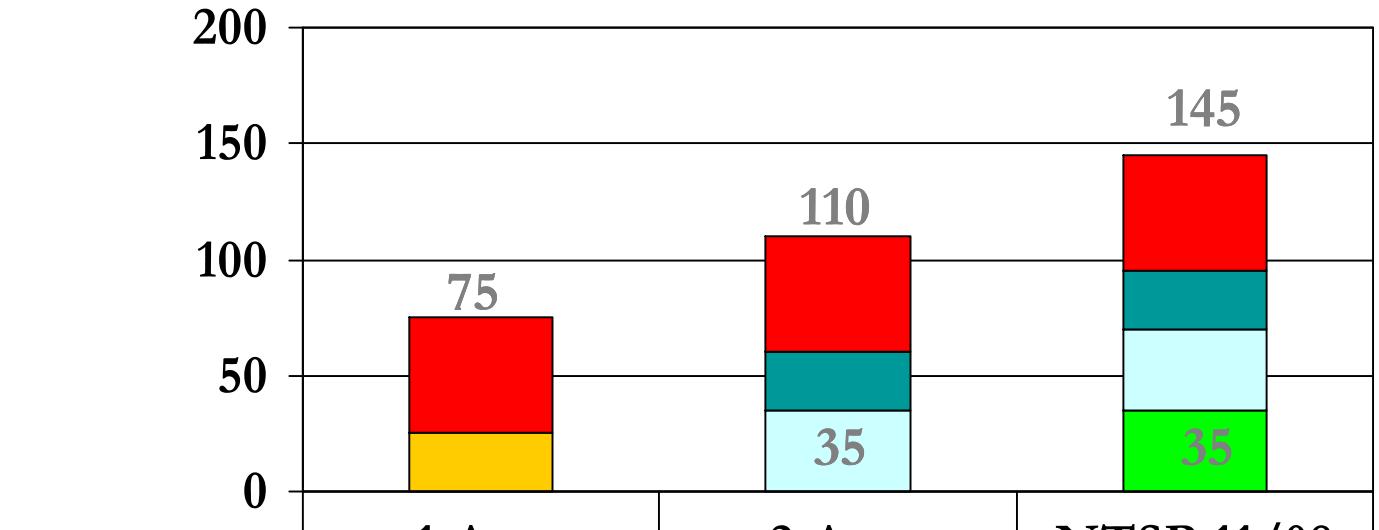
- **Warm weather**
- **Low water level / slow current**
- **Congestion / reduced forward motion of vehicles**
- **Seatbelts and automobile construction**
- **'Cushion' of bridge collapsing under vehicles**
- **Vehicle position / direction on the bridge span**
- **Proximity to hospitals and resources**
- **Luck!**

Hennepin County
Medical Center

Construction Lane Closures


26 y.o. male. Wheel chair marathon racer. Uninjured. Drove van into median barrier to bring van to a stop. Waited for bystanders to get out of van.
36 y.o. male. Believed to have survived initial impact but died from mechanical asphyxiation after being struck by collapsing overhead highway sign support beam. Survived by his wife and 2 children.
58 y.o female. Initially thought there was an earthquake. After the impact she crawled out passenger door. Back injury.
Top Pickup. 47 y.o. male. His truck fell backward landing on 2nd vehicle. Compressed frx of vertebrae with broken wrist. Walked off bridge on his own.
Bottom SUV. 28 y.o male. Accelerated when he felt bridge going down – drove down the ramp where pickup landed on top of him. Conscious during extrication. Head trauma, multiple vertebral frxs, severe facial trauma, rib frxs, collapsed lung, foot frx. Hospitalized 37 days.
33 y.o.female. Got out of her car and climbed down rickety ladder. Called friend who gave her a ride to hospital. 2 herniated disks in her back.
18 y.o female. No recollection of bridge collapse. Frx of 4 vertebrae and rib frx. Hospitalized 8 days.
51 y.o. male. Uninjured. Had put car in reverse when he saw bridge going down. Not much of a jolt on impact. Main damage to car caused by hoist straps when car lifted off bridge.
Information compiled using reports in StarTribune

Injury Totals



	1-Aug	2-Aug	NTSB 11/08
EMS	50	50	50
Walk-ins	25	25	25
Next Day		35	35
Next Year			35

Clearing the ED

- Charge Nurse and Staff Doc went to each treatment area and cleared patients
- Special Care used as triage area
- Cleared all of Team A -15 beds
- Cleared all of Team B- 13 beds
- Used Team C and express care for ongoing patients
- Admissions went straight up without delay

HCMC Response

- **25 patients received in 2 hours**
  - **1 dead on arrival**
  - **6 intubated**
  - **5 directly to OR**
  - **16 total admissions (60%)**

- **By 7pm:**
  - **25 ICU beds open**
  - **10 OR open and staffed**
  - **3 CT scanners running**

Lack of Information

- Most difficult issue in ED was lack of information
- Public saw images before we did
- MRCC was not clear on the extent of injuries
- No direct contact with EMS supervisors/MD's from scene to ED
- Unsure if disaster alert was needed

Transitions

- Transition # 1: From a Community Response to Public Safety Response

- 7:27 PM
  Transition # 2: From Rescue to Recovery

- Transition #3 : From “Our Bridge” to a Crime Scene / Recovery Zone

Additional Considerations in Large Incidents

- **On-going support of incident operations**
- **Demobilization**
- **On-going / next day department operations**
- **Impact of media**
- **Managing volunteers**
- **Crowd management /scene access**
- **VIP's**
- **National attention: praise and scrutiny**
- **Regional, State and National response partners**
- **Reimbursements – document, document**
- **Critical Incident Stress Management**
- **Continuing impact on staff and department**

Reflections: recent events

- Plan and train for most likely hazards …
  -- but the unlikely can happen --
- If response infrastructure remains intact, successful coordination more likely
- Initial scene dynamics may be un-controllable
- Tracking patients/survivors always challenging
- Geographic and political challenges are common – address them in advance

Comparisons between bridge collapse and ditching of U S Airways 1549 …..

Hennepin County
Medical Center